

CLAIMS

1. A high-strength hot-rolled steel sheet excellent in hole expandability, and ductility, containing in terms of a mass%:

5 C: 0.01 to 0.09%,
 Si: 0.05 to 1.5%,
 Mn: 0.5 to 3.2%,
 Al: 0.003 to 1.5%,
 P: 0.03% or below,
10 S: 0.005% or below,
 Ti: 0.10 to 0.25%,
 Nb: 0.01 to 0.05%, and
 the balance consisting of iron and unavoidable
15 impurities;
 satisfying all of the following formulas <1> to <3>:

$0.9 \leq 48/12 \times C/Ti < 1.7$. . . <1>

$$50,227 \times C - 4,479 \times Mn > -9,860 \dots <2>$$

811 x C + 135 x Mn + 602 x Ti + 794 x Nb > 465
 . . . <3>, and

having strength of at least 980 N/mm².

2. A high-strength hot-rolled steel sheet excellent in hole expandability and ductility, containing in terms of a mass%:

C: 0.01 to 0.09%,

25 Si: 0.05 to 1.5%,

Mn: 0.5 to 3.2%,

Al: 0.003 to 1.5%,

P: 0.03% or below

S: 0.005% or below

Ti: 0.10 to 0.25%,

Nb: 0.01 to 0.05%,

at least one of

Mo: 0.05 to 0.4

the balance consisting of iron and unavoidable

rities:

satisfying

Subscribing all of the following:

$0.9 \leq 4\phi/12 \times C_{II} < 1.1$. . . (1)

50,227 x C - 4,479 x (Mn + 0.57 x Mo + 1.08 x V) >
-9,860 . . . <2>'
811 x C + 135 x (Mn + 0.57 x Mo + 1.08 x V) + 602 x
Ti + 794 x Nb > 465 . . . <3>, and
5 having strength of at least 980 N/mm².

10 3. A high-strength hot-rolled steel sheet excellent in hole expandability and ductility according to claim 1 or 2, which further contains, in terms of mass%, 0.0005 to 0.01% of at least one of Ca, Zr and REM.

15 4. A high-strength hot-rolled steel sheet excellent in hole expandability and ductility according to any of claims 1 through 3, which further contains, in terms of mass%, 0.0005 to 0.01% of Mg.

15 5. A high-strength hot-rolled steel sheet excellent in hole expandability and ductility according to any of claims 1 through 4, which further contains, in terms of mass%, at least one of:

Cu: 0.1 to 1.5% and

Ni: 0.1 to 1.0%.

20 6. A production method of a high strength hot rolled steel sheet excellent in hole expandability and ductility according to any of claims 1 through 5, comprising the steps of:

25 finishing hot rolling by setting a rolling end temperature to from an Ar₃ transformation point to 950°C;

cooling a hot rolled steel sheet to 650 to 800°C at a cooling rate of at least 20°C/sec;

30 cooling then the steel sheet for 0.5 to 15 seconds;

further cooling the steel sheet to 300 to 600°C at a cooling rate of at least 20°C/sec; and coiling the steel sheet.